

**Notice of Allowability**

Application No.

10/067,429

Examiner

Tiffany A Feltzner

Applicant(s)

VISSER ET AL.

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**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 11/03/2004 and the telephonic interview of 11/09/2004.
2. ☒ The allowed claim(s) is/are 1-16.
3. ☒ The drawings filed on 6/16/2003 (Fig 1) & 02/05/2002 figs 1-8 are accepted by the Examiner.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☒ All   b) ☐ Some\*   c) ☐ None   of the:
    1. ☒ Certified copies of the priority documents have been received.
    2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
  6. ☒ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
    - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
      - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
    - (b) ☒ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date 11/10/2004.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08),  
Paper No./Mail Date \_\_\_\_\_
4. ☐ Examiner's Comment Regarding Requirement for Deposit  
of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413),  
Paper No./Mail Date 11/10/2004.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other \_\_\_\_\_.

**Examiner's Amendment**

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.
2. Authorization for this examiner's amendment was given in a telephone interview with **Attorney George Likourezos Reg. No. 40067** on November 10<sup>th</sup> 2014 along with authorization to charge any necessary fees to applicant's deposit account.
3. The application has been amended as follows:

**A) Replace claim 1 with the following Examiner amended claim 1:**

**Claim 1** --- A magnetic resonance imaging apparatus comprising:

an RF coil system comprising at least two sets of at least two RF coils which detect RF signals from a region of interest,

at least two receiver channels which receive and, process the detected RF signals, and

a control unit which controls at least a plurality of switches, depending on the imaging parameters, that selectively route and / or divert a first and a second detected RF signal from a first set of the at least two RF coils towards separate receiver channels via different paths of at least two possible paths, where a switch of said plurality of switches is positioned along each path of said at least two possible paths defining at least four possible paths, the plurality of switches selectively diverting said first and second detected RF signals along two different paths of the at least four possible paths, wherein at least one selectively diverted first and second detected RF signal is combined with a respective detected RF signal from a second set of the at least two RF coils which has been selectively diverted by a different switch of said plurality of switches along another additional path and forms combined signals therefrom, wherein the additional path includes a portion of one of said two different paths of said at least four possible paths; and said control unit applies the combined RF signals to separate receiver channels.

**B) Replace claim 2 with the following Examiner amended claim 2:**

**Claim 2** --- A magnetic resonance imaging apparatus as claimed in **claim 1**, wherein said control unit is provided and combines the detected RF signals of several groups of the at least two RF coils into a separate receiver channel. ---

**C) Replace claim 3 with the following Examiner amended claim 3:**

**Claim 3** --- A magnetic resonance imaging apparatus as claimed in **claim 1**, wherein said RF coil system comprises two sets of four RF coils. ---

**D) Replace claim 4 with the following Examiner amended claim 4:**

**Claim 4** --- A magnetic resonance imaging apparatus as claimed in **claim 1**, wherein said RF coil system comprises a birdcage head coil arrangement. ---

**E) Replace claim 5 with the following Examiner amended claim 5:**

**Claim 5** --- A magnetic resonance imaging apparatus as claimed in **claim 4**, wherein said control unit is provided and combines the detected RF signals of RF coils arranged on opposite sides of the head. ---

**F) Replace claim 6 with the following Examiner amended claim 6:**

**Claim 6** --- A magnetic resonance imaging apparatus as claimed in **claim 1**, wherein said control unit is provided and combines the detected RF signals of neighboring RF coils. ---

**G) Replace claim 7 with the following Examiner amended claim 7:**

**Claim 7** --- A magnetic resonance imaging apparatus as claimed in **claim 1**, wherein said control unit which is provided selects and/or combines the detected RF signals of the at least two RF coils depending on the phase encoding direction. ---

**H) Replace claim 8 with the following Examiner amended claim 8:**

**Claim 8** --- A magnetic resonance imaging apparatus as claimed in **claim 1**, wherein said control unit which is provided selects and/or combines the detected RF signals of the at least two RF coils depending on the desired SENSE reduction direction. ---

**I) Replace claim 9 with the following Examiner amended claim 9:**

**Claim 9** --- A magnetic resonance imaging method, comprising the steps of:  
detecting RF signals from a region of interest while using an RF coil system comprising at least two sets of at least two RF coils,  
receiving and processing the detected RF signals while using at least two receiver channels,  
controlling a plurality of switches depending on the imaging parameters that selectively route and / or divert a first and a second detected RF signal from a first set of the at least two RF coils towards separate receiver channels via different paths of at

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least two possible paths, where a switch of said plurality of switches is positioned along each respective path of said at least two possible paths defining at least four possible paths, wherein the plurality of switches selectively diverts said first and second detected RF signals along two different paths of said at least four possible paths, wherein at least one selectively diverted first and second detected RF signal is combined with a respective detected RF signal from a second set of the at least two RF coils which has been selectively diverted by a different switch of said plurality of switches along another additional path and forms combined signals therefrom, wherein the additional path includes a portion of one of said two different paths of said at least four possible paths; and

applying the combined RF signals to separate receiver channels. ---

**J) Replace claim 10 with the following Examiner amended claim 10:**

**Claim 10** ---The method as claimed in **claim 9**, wherein said controlling step comprises the step of combining detected RF signals of several groups of the at least two RF coils into a separate receiver channel.

**K) Replace claim 11 with the following Examiner amended claim 11:**

**Claim 11** ---The method as claimed in **claim 9**, wherein said RF coil system comprises two sets of four RF coils. ---

**L) Replace claim 12 with the following Examiner amended claim 12:**

**Claim 12** ---The method as claimed in **claim 9**, wherein said RF coil system comprises a birdcage head coil arrangement. ---

**M) Replace claim 13 with the following Examiner amended claim 13:**

**Claim 13** ---The method as claimed in **claim 12**, wherein said controlling step combines the detected RF signals of RF coils arranged on opposite sides of the head.

**N) Replace claim 14 with the following Examiner amended claim 14:**

**Claim 14** ---The method. as claimed in **claim 9**, wherein said controlling step combines the detected RF signals of neighboring RF coils. ---

**O) Replace claim 15 with the following Examiner amended claim 15:**

**Claim 15** ---The method as claimed in **claim 9**, wherein, said controlling step selects and/or combines the detected RF signals of the at least two RF coils depending on the phase encoding direction. ---

**P) Replace claim 16 with the following Examiner amended claim 16:**

**Claim 16** ---The method as claimed in **claim 9**, wherein said controlling step selects and/or combines the detected RF signals of the at least two RF coils depending on the desired SENSE reduction direction.

**Q) In the title: Replace the current title with the following:**

**"MRI Apparatus and Method for Selectively Routing/Diverting and Combining Signals Along Different Paths"**

**R)** In the **Original specification on page 6 after line 15 insert** the following:

The magnetic resonance imaging apparatus shown by FIG. 4 includes an RF coil system having at least two sets of at least two RF coils 9, 10 and 11, 12 which detect RF signals from a region of interest, at least two receiver channels C1 and C2 which receive and process the detected RF signals, and a plurality of switches 52 that selectively route a first and a second detected RF signal from a first set of the at least two RF coils 9, 10 towards separate receiver channels C1 and C2 via different paths of at least two possible paths. A switch of the plurality of switches is positioned along each path of the at least two possible paths defining at least four possible paths, for selectively diverting the first and second detected RF signals along two different paths of the at least four possible paths. At least one selectively diverted first and second detected RF signal is combined with a respective detected RF signal from a second set of the at least two RF coils 11, 12 which has been selectively diverted by a different switch of the plurality of switches along another additional path depending on the imaging parameters to form combined signals within combining component 53. The additional path includes a portion of one of the two different paths of the at least four possible paths. The combined RF signals of component 53 are applied to separate receiver channels C1 and C2.

The following is an examiner's statement of **Reasons for Allowance**:

4. With respect to **Examiner amended claims 1-16** These claims are allowable over the prior art of record because the prior art of record does not disclose or suggest an MRI apparatus/method comprising "an RF coil system comprising at least two sets of at least two RF coils which detect RF signals from a region of interest, at least two receiver channels which receive and, process the detected RF signals, and a control unit which controls at least a plurality of switches, depending on the imaging parameters, that selectively route and / or divert a first and a second detected RF signal

from a first set of the at least two RF coils towards separate receiver channels via different paths of at least two possible paths, **where a switch of said plurality of switches is positioned along each path of said at least two possible paths defining at least four possible paths, the plurality of switches selectively diverting said first and second detected RF signals along two different paths of the at least four possible paths, wherein at least one selectively diverted first and second detected RF signal is combined with a respective detected RF signal from a second set of the at least two RF coils which has been selectively diverted by a different switch of said plurality of switches along another additional path and forms combined signals therefrom, wherein the additional path includes a portion of one of said two different paths of said at least four possible paths; and said control unit applies the combined RF signals to separate receiver channels.**", in combination with the remaining limitations of each of the claims. **It is the combination of the claim limitations taken as a whole that constitutes both the novelty and non-obviousness of applicant's claims.**

5. The examiner notes that in the prior art of record, once a signal is received along a particular path, or route as in **Burl et al., Vij et al., Misic or Srinivasan et al.**, that the path the signal follows is fixed, that there is no alteration or diverting of the signal to a different path. In applicant's **examiner amended claims 1 and 9** which are free of new matter because the examiner amended claims are supported by applicant's originally filed figures 4 and 7, the plurality of switches shown as component 52 in the figures selectively divert the path of the received signals, which begin when a particular coil detects/receives a signal onto a different path, depending on the imaging parameters, as specified in the examiner amended claims. In other words a signal from coil 9 or 12 in applicant's invention is selectively combined with a signal from coil 11 or 10 prior to being combined by component 53 to either channel 1 or channel 2. In applicant's invention the signal path is not fixed due to the location of the plurality of switches component 52 in applicant's invention, which occurs after phase component 51 and before combining component 53. **The applicant's examiner amended independent**



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**claims are supported by figures 4 and 7, which are considered to be novel by the examiner.**

6. The structure shown in applicant's figures 2 and 3 are taught and found within the prior art, as illustrated by the prior arts of **Burl et al., Vij et al., Misic and Srinivasan et al., etc.** However, **the component configuration of applicant's figure 4 and 7 which includes the plurality of switch components 52 is not found within the prior art, and it is figures 4 and 7 which are claimed and recited in applicant's examiner amended after-final claims 1-16.**

7. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

#### **Examiner's Comment**

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

#### **Priority**

9. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

#### **Drawings**

10. The proposed red-ink drawing correction to figure 1 of June 16<sup>th</sup> 2003, which labels Figure 1 as prior art is approved by the examiner. Applicant must now submit a new formal drawing of figure 1 which includes the approved correction

11. Applicant is advised to employ the services of a competent patent draftsman outside the Office, as the U.S. Patent and Trademark Office no longer prepares new

drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

### ***Response to Arguments***

12. Applicant's arguments filed with the November 3<sup>rd</sup> 2004 after-final amendment response, which has been marked "Do not enter" by the examiner due to the fact that problems in the wording and antecedent basis of the proposed after-final amended claims still remained, have been fully considered, and in view of the Examiner's amendments of November 10<sup>th</sup> 2004, to the claims submitted in the after-final amendment of November 3<sup>rd</sup> 2004 the arguments are persuasive, because the examiner amended independent claims which list in words the features shown in applicant's originally filed figures 4 and 7, structurally distinguish over the prior art of record, and are free of new matter.

13. The **prior art made of record** and not relied upon is considered pertinent to applicant's disclosure.

- A) US patent 6,469,506 B1 issued October 22<sup>nd</sup> 2002, to **Felmlee et al.**, filed June 15<sup>th</sup> 2000 which shows multiple sets of two receiver coils in an MRI phased array coil where the signals from one coil or set are combined to form a single output image signal from the array of coils.
- B) **Burl et al.**, US patent 6,377,044 issued April 23<sup>rd</sup> 2002; filed March 1<sup>st</sup> 2000.
- C) **Pruessmann et al.**, article "SENSE: Sensitivity encoding for Fast MRI" Magnetic Resonance in Medicine 42: pages 952-962 1999.
- D) **Srinivasan et al.**, US patent 5,664,568 issued September 9<sup>th</sup> 1997
- E) **Misic** US patent 6,356,081 B1 issued March 12<sup>th</sup> 2002, filed November 24<sup>th</sup> 1999.
- F) **Vij et al.**, US patent 5,370,118 issued December 6<sup>th</sup> 994.
- G) **Pelc et al.**, US patent 5,399,970 issued March 21<sup>st</sup> 1995.
- H) **Keren** US patent 5,160,891 issued November 3<sup>rd</sup> 1992.

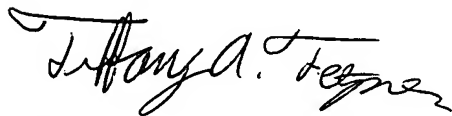
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I) **Bock et al.**, US patent 6,549,799 B2 issued April 15<sup>th</sup> 2003, filed April 18<sup>th</sup> 2001 which is noted for the purpose of a complete record, but is not prior art because applicant has an earlier effective priority date of February 9<sup>th</sup> 2001.

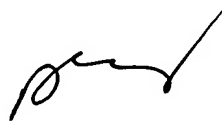
### Conclusion

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is: (571) 272-2241. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

15. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez, can be reached at (571) 272-2245. The **only official fax phone number** for the organization where this application or proceeding is assigned is **(703) 872-9306**.



TAF  
November 10, 2004



Diego Gutierrez  
Supervisory Patent Examiner  
Technology Center 2800